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April 27, 2012
B&V Project No. 176602

Mr. David J. Worthington
Dept of Environmental Quality
Revolving Loan Programs
Constitution Hall 3rd Floor South
525 West Allegan
P.O. Box 30241
LANSING MI 48933-1502

Re: Green Project Reserve
Clean Water Revolving Fund (CWRF)
City of Grand Rapids

Dear Mr. Worthington:

This letter presents the North Aeration Blower Improvements Project at the Grand Rapids Wastewater Treatment Plant for Green Project Reserve (GPR) funding.

The project upgrades the existing aeration blower system in the North Secondary Treatment System and provides energy savings in excess of 20 percent versus the current system. Proposed improvements are being submitted under the Energy Efficiency Section 3.0, specifically paragraph 3.2-2 of the Guidance Document, as a project that achieves at least a 20% reduction in energy consumption. Therefore a business case for the portion of the project is not required.

Background
The project was reviewed in detail in the *North Secondary Treatment Improvements Preliminary Design Report* (Tetra Tech, Inc. 2009) and costing information is detailed in the CWRF Project Plan. The preliminary design report details the basis of design.

The project includes the following components and as a whole the project provides an energy savings in excess of 20 percent versus current technology and is presented for GPR funding consideration:

- Two new 10,000 SCFM (each) Blowers.
- Associated electrical and instrumentation controls package for blowers.
- Air piping system modifications to install new blowers.

All items in the project are integral to the project and are thus intended to be GPR qualifying.

The cost of the North Aeration Blower Improvements project as presented in the CWRF is $2,388,805 and includes $1,846,900 for construction cost, $135,215 for contingency, $184,690 for design engineering and $222,000 for construction engineering, administration, and inspection. The 20-year present worth for the initial capital cost of ($7,447,879) of the project is less than the 20-year present worth O&M cost for the existing ($7,542,147) blower system without the improvements. The payback period, that is the project cost $2,388,805 divided by the cost savings for reduced energy usage ($174,283 per year), is 13.7 years for this work.

Conclusion
In summary, based on these analyses, we request consideration for the GPR per FY 2012 Appropriations Law (P.L. 111-88) for the North Aeration Blower Improvements project as an Energy Efficiency category project.

We understand that items which are determined to be GPR qualifying will need to be identified as separate items in a bid proposal and not lumped in with any non-qualifying items.

Sincerely,
BLACK & VEATCH

Jeff A. Glover, P.E.
Project Engineer

Attachments: Project Cost Calculations
cc: Mr. Breese Stam, P.E. – City of Grand Rapids
Mr. David Koch, P.E. – Black & Veatch

Cost Estimate Backup Calculation Information

O&M Cost Calculations - The backup calculations are from a previous report/study for the project.

Other Costs are in attached Spreadsheet including:

- Salvage Value Cost Calculations
- Present Worth of O&M and Salvage Value Calculations
- Formula used for each calculation type (Formulas used are directly from the CWRF Guidance Document, or otherwise clearly explained.)

North Aeration Blower Improvements Alternatives

The O&M Costs of the North Aeration Blower Improvements Alternative and the No Action Alternative were previously documented in the Preliminary Design Report for the North Secondary Treatment Improvements. Select pages are reproduced herein and describe the O&M Costs.

The O&M Cost for the North Aeration Blower Improvements Alternative is $399,265 per year. This cost consists of electrical energy cost of $0.072 per kilo-watt hour with blower power consumption and costs as described in attached Table 3 from Appendix 3 of the preliminary design report.

The O&M Cost for the No Action Alternative is $573,548 per year. This cost consists of electrical energy cost of $0.072 per kilo-watt hour with blower power consumption and costs as described in attached Table 1 from Appendix 3 of the preliminary design report.

See the attached spreadsheet at the end of this section for Present Worth of O&M, Salvage Value and Present Worth of Salvage Value Calculations.

TABLE 3
OPTION III - HYBRID SYSTEM, TWO (2) NEW TURBLEX SINGLE STAGE BLOWER, RATED FOR 10,000 SCFM @10.75 psig

STANDARDS

ndard Pressure (PSIA)	14.7 PSIA
S Temperature (deg F)	68 deg F
dard Relative Humidity	36%

SITE CONDITIONS

metric Pressure (PSIA)	14.4 PSIA
Winter Air Temperature	10 deg F
inter Relative Humidity	30%
/ Fall Air Temperature	50 deg F
/ Fall Relative Humidity	65%
mmer Air Temperature	100 deg F
mmer Relative Humidity	65%

TOTAL AIR REQUIREMENTS

Number of Operating Blowers	3
Maximum Discharge Pressure	10.75 PSIG

ENERGY COST

Current Average Energy Cost (2008)	0.072 $/kWh
Estimated Annual Increase in Energy Cost	3.00%

Process Air Flow (scfm)	Discharge Pressure	New 600 Hp Turblex Single-Stage Air Flow (scfm)	New 600 Hp Turblex Single-Stage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Air Temp °F	Humidity % RH	New 600 Hp Turblex Single-Stage Shaft Hp	New 600 Hp Turblex Single-Stage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Motor Efficiency Multistage	Motor Efficiency Single-Stage	Total Blowers Shaft kW	Annual Hours of Operation	Energy Consumption kWh	Average Energy Cost ($)	Total Energy Cost ($)
22,000	10.75	8,250	8,250	5,500	0	0	100	65%	449	449	351	0	0	0.90	0.95	996	0.25	2,190,287	0.072	$156,981
15,000	10.75	7,500	7,500	0	0	0	50	65%	372	372	0	0	0	0.90	0.95	583	0.50	2,554,527	0.072	$183,926
10,000	10.75	10,000	0	0	0	0	10	30%	472	0	0	0	0	0.90	0.95	370	0.25	810,534	0.072	$58,359

NOTE: Energy consumption of multistage blowers was based upon curve provided by Grand Rapids personnel.

TOTAL ANNUAL ENERGY COST YEAR 2009 $399,265

TABLE 1
OPTION I -EXISTING SYSTEM, FIVE (5) MULTISTAGE BLOWERS

STANDARDS

ndard Pressure (PSIA)	14.7 PSIA
l Temperature (deg F)	68 deg F
dard Relative Humidity	36%

SITE CONDITIONS

netric Pressure (PSIA)	14.4 PSIA
Winter Air Temperature	10 deg F
inter Relative Humidity	30%
/ Fall Air Temperature	50 deg F
/ Fall Relative Humidity	65%
mmer Air Temperature	100 deg F
mer Relative Humidity	65%

TOTAL AIR REQUIREMENTS

Number of Operating Blowers	4
Maximum Discharge Pressure	10.75 PSIG

ENERGY COST

Current Average Energy Cost (2006)	0.072 $/kWh
Estimated Annual Increase in Energy Cost	3.00%

Process Air Flow (scfm)	Discharge Pressure	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Existing 450 Hp Multistage Air Flow (scfm)	Air Temp °F	Humidity % RH	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Existing 450 Hp Multistage Shaft Hp	Motor Efficiency	Total Blowers Shaft kW	Evaluation Weight Factor	Energy Consumption kWh	Average Energy Cost ($)	Total Energy Cost ($)
22,000	10.75	5,500	5,500	5,500	5,500	0	100	65%	351	351	351	351	0	0.90	1,163	0.25	2,547,651	0.072	$183,431
15,000	10.75	5,000	5,000	5,000	0	0	50	65%	370	370	370	0	0	0.90	920	0.50	4,028,337	0.072	$290,040
10,000	10.75	5,000	5,000	0	0	0	10	30%	383	383	0	0	0	0.90	635	0.25	1,389,958	0.072	$100,077

NOTE: Energy consumption of multistage blowers was based upon curve provided by Grand Rapids personnel.

TOTAL ANNUAL ENERGY COST YEAR 2009 $573,548

State Revolving Fund (SRF) Project No. To Be Determined
North Aeration Blower Improvements
Grand Rapids Wastewater Treatment Project Plan
Green Project Reserve (GPR)

April 27, 2012

		Formulas
Annual O&M Cost for current north aeration blowers is =	$573,548	A
Annual O&M Cost for proposed blowers improvements is =	$399,265	B
Detailed costs breakdowns for the above numbers are as described in the attached Tables 1 and 3.		
The difference in annual O&M Cost between the current system and the proposed system is =	$174,283	A-B
The entire North Aeration Blower Improvements project is necessary for the savings in energy cost. The project cost of the total project is =	$2,388,805	C
Detailed cost breakdown for the project cost are included in the cost estimate backup portion of the project plan. (Excerpt Attached)		
The payback period on the project is the total project cost divided by the annual O&M cost savings.	**13.7 years**	C/(A-B)

3.2 Analysis of Principal Alternatives

3.2.1 North Aeration Blower Improvements

3.2.1.1 Monetary Evaluation.

A cost effective analysis was completed for each of the two principal alternatives. Note that backup calculations for O&M Costs, Salvage Value Costs, and Present Worth Costs are presented in Appendix K.

Principal Alternative

The cost analysis of the North Aeration Blower Improvements is based on the project improvements as described in Section 3.1.1.4.

Table 3-3
Estimated Project Cost Summary for North Aeration Blower Improvements Alternative

Item	Initial Estimates Capital Cost	Design Life (years)	Salvage Value
Two - 10,000 SCFM Blowers	$1,351,020	30	$450,340
Blower Installation and Piping Modifications	$285,890	20	
Electrical and Instrumentation Controls Package	$209,990	20	$0
Design Engineering	$184,690		
CE/I/Admin (12%)	$222,000		
Contingency (6%)	$135,215		
Subtotal - Estimated Project Budget	$2,388,805		

No Action Alternative

The No Action Alternative has additional associated operational costs due to continued use of the existing blowers, while the North Aeration Blower Improvements alternative replaces two of the existing blowers providing a significant cost savings by increasing energy efficiency.

Present Worth Analysis

Sunk costs are not included in the analysis. Sunk costs include any investments or financial commitments made before or during the project planning. These costs include the cost of the

existing facilities, land, outstanding bond indebtedness, etc. Day-to-day operation costs are not assumed to vary significantly from the alternatives. Table 3-4 shows the present worth analysis for the alternatives.

Table 3-4
Present Worth Analysis for North Aeration Blower Improvements Alternative

Component	North Aeration Blower Improvements		No Action	
	Actual Cost	20-year Present Worth	Actual Cost	20-year Present Worth
Initial Capital Cost	$2,388,805	$2,388,805	$0	$0
Annual O&M Cost	$399,265	$5,250,328	$573,548	$7,542,147
Salvage Value	$450,340	($191,254)	$0	$0
Total 20-year Present Worth Estimate		$7,447,879		$7,542,147

3.2.1.2 Staging Construction.

The construction will be performed as a single contract. There is no benefit to staging/partitioning the work, as the work is within a single process area of the WWTP.

3.2.1.3 Partitioning the Project.

The construction will be performed as a single contract. There is no benefit to staging/partitioning the work, as the work is within a single process area of the WWTP.

3.2.1.4 Environmental Evaluation.

Cultural Resources

The work for the North Aeration Blower Improvements project will occur inside of property owned by the City of Grand Rapids. There will be no direct impact on any site outside of the existing WWTP during construction of the project.

The Natural Environment

Climate effects are not anticipated to affect the completion of the projects. Air quality will be temporarily impacted due to the exhaust of the heavy machinery required for construction. The construction will result in a temporary increase in noise. These factors may be noticeable to the nearby property owners, but will be controlled to the greatest extent possible by limiting construction to regular working hours during the week. The projects will not affect any nearby water bodies or flood plains, nor will they affect agricultural lands.

4.1.5 Mitigation of Environmental Impacts

See Section 5.0 for general discussion on environmental impacts.

4.1.6 Schedule for Design and Construction

The North Aeration Blower Improvements are scheduled for FY 2013 with a bid advertisement date in late 2012 for funding in the 2nd Quarter of FY 2011. The schedule is detailed in the project evaluation and review table (PERT) in Appendix E.

4.2 Monetary Cost Estimate

The present worth analyses of the alternative was presented earlier in Section 4.0. This section summarizes the alternative's estimated project costs including engineering design, administrative and legal costs, and construction. The cost estimates presented in this report reflect April 2012 costs. These cost estimates were prepared to determine approximate project costs to aid the City in its planning and budgeting process. There are a number of factors that could cause the actual project costs to deviate from these estimates. These include the competitive bidding climate at the time that the construction bids are received, inflation, and additions to or changes in the scope of the project that may occur during the design process.

The total estimated capital cost for the project is summarized below.

Table 4-1
Summary of Estimated Capital Costs

Project	Total Estimated Project Cost
North Aeration Blower Improvements	$2,388,805
Total	$2,388,805

Breaking the cost between estimated capital cost, contingencies, and engineering/ administration/and legal produces the following:

Table 4-2
Breakdown of Estimated Project Costs

Estimated Capital Cost	$2,031,590
Project Contingency	$135,215
Engineering, Administration, Legal	$222,000
Total	$2,388,805

4.2.1 User Costs

The project is an integrated cost that benefits all users. The costs are distributed proportionately among users through a commodity charge based on the current sewer usage.

City of Grand Rapids
Grand Rapids Metropolitan Area Project Plan
Calculation of Present Worth of OM, Salvage Value and of Present Worth of Salvage Value

		A	B	C	D	E	F	G	H
Project	Construction Cost	Annual OM Cost	Construction Cost	Design Life	EPA Discount Rate	Planning Period	Present Worth of OM	Salvage Value Future Cost	Present Worth of Salvage Value
		$	$	years	%	years	formula - F = A*[(1+D)^E-1/(1+D)^E]	formula - G = B*(C-E)/C	formula - H = G/(1+D)^E
North Aeration Blower Improvements	Two - 10,000 SCFM Blowers		$1,351,020	30	4.375%	20		$450,340	$191,254
	Blower Installation and Piping Modifications		$285,890	20	4.375%	20		$0	$0
	Electrical and Instrumentation Controls Package		$209,990	20	4.375%	20		$0	$0
	Complete North Aeration Blower Improvements Project	$399,265	$1,846,900	varies	4.375%	20	$5,250,328	$450,340	$191,254
	No Action North Blower Improvements Project	$573,548	$0	varies	4.375%	20	$7,542,147	$0	$0

Notes:
1. Column letter designations A, B, C are used in the formulas listed below the named values which are calculated. The columns not listing a formula are given values, not calculated in this worksheet.
2. Column F and H formulas are the same as the formulas provided in the SRF Guidance Document.